

DATA ANALYSIS APPLICATION ON REAL ESTATE MARKET IN SERBIA

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Abstract: This paper analyzes the real estate market in Serbia in the period from 2019 to 2024, with a focus on the main urban centers: Belgrade, Novi Sad and Niš. The aim of the paper is to identify trends and dynamics in the real estate market, as well as to analyze the impact of global and local factors on this market. The methodology includes collecting and processing data from official sources, as well as using the Power BI tool for data analysis and visualization. The results show a constant increase in real estate prices in the analyzed cities, with the presence of different trends in new and old construction.

Key words: real estate, data analysis, Power BI

1. INTRODUCTION

Data science is a deep study of the massive amount of data, which involves extracting meaningful insights from raw, structured, and unstructured data that is processed using the scientific method, different technologies, and algorithms. It is related to data mining, deep learning and big data. According to the wide range of application areas needed knowledge, it can be said that data science is a multidisciplinary field that uses tools and techniques to collect, clean, manipulate the data so that decision maker can find something new and meaningful in them. Depending of a problem that has to be analysed, data science may need the most powerful hardware, programming systems, and the most efficient algorithms to solve the data related problems. That is why is said that data science is the future of artificial intelligence.

The novelty of data science is not rooted in the latest scientific knowledge, but in a disruptive change in our society that has been caused by the evolution of technology: datification. Datification is the process of rendering into data aspects of the world that have never been quantified before [1]. Datification include creating a huge amount of data, organization of data, data clinsing and analysis.

The analysis phase is where data scientists are most heavily involved. In this context, the different tools are using to include summarization of the data, using portions of data (samples) to make inferences about the larger context, and visualization of the data by presenting it in tables, graphs, and even animations. Although there are many technical, mathematical, and statistical aspects to these activities, the ultimate audience for data analysis is always a person or people. These people are the data users, and fulfilling their needs is the primary job of a data scientist [2].

Keeping up with market trends is essential for any business; it's vital to staying ahead of the competition and ensuring continuous growth [3]. Trend analysis is a technique used in technical analysis that attempts to predict future stock price movements based on recently observed trend data. Trend analysis uses historical data, such as price movements and trade volume, to forecast the long-term direction of market sentiment [4]. Market trends analysis focuses on researching and monitoring changes in the market to identify gaps, patterns, and opportunities [3]. Mapping market trends can be a game-changer for any business. It allows you to:

- Find new opportunities,
- Stay competitive,
- Make smarter business decisions [3].

Trend analysis tries to predict a trend, such as a bull market run, and then ride that trend until data suggests a trend reversal, such as a bull-to-bear market. It is based on the idea that what has happened

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in the past gives traders an idea of what will happen in the future. Trend analysis focuses on three typical time horizons: short; intermediate; and long-term [4].

There are three main types of market trend for analysts to consider:

- Upward trend: An upward trend, also known as a bull market, is a sustained period of rising prices in a particular security or market. Upward trends are generally seen as a sign of economic strength and can be driven by factors such as strong demand, rising profits, and favorable economic conditions.
- Downward trend: A downward trend, also known as a bear market, is a sustained period of falling prices in a particular security or market. Downward trends are generally seen as a sign of economic weakness and can be driven by factors such as weak demand, declining profits, and unfavorable economic conditions.
- Sideways trend: A sideways trend, also known as a rangebound market, is a period of relatively stable prices in a particular security or market. Sideways trends can be characterized by a lack of clear direction, with prices fluctuating within a relatively narrow range [4].

2. REAL ESTATE MARKET

The real estate market refers to the transaction of properties, including residential properties (such as houses and apartments) and commercial properties, such as office buildings and industrial properties. Apart from property sales, this market includes leases and the value of real estate. The real estate market encompasses all activities related to buying, selling, renting and investing in real estate. In recent years, the real estate market has experienced significant changes, both globally and locally. Real estate can be divided into several basic types:

1. Residential real estate: houses, flats, apartments, other real estate used for housing.
2. Commercial real estate: office spaces, shops, shopping malls and facilities used for commercial purposes.
3. Industrial real estate: premises, shops, shopping malls and facilities used for commercial purposes.
4. Land: agricultural, construction and industrial land.

The Real Estate market worldwide is expected to reach a staggering value of US\$634.90tn by 2024. Looking ahead, the sector is anticipated to grow at an annual rate of 2.77% (CAGR 2024-2029), resulting in a market volume of US\$727.80tn by 2029 [5]. On Figure 1 and Figure 2 the state of real estate market from 2017 with the prediction for 2029 are given, retrospectively.

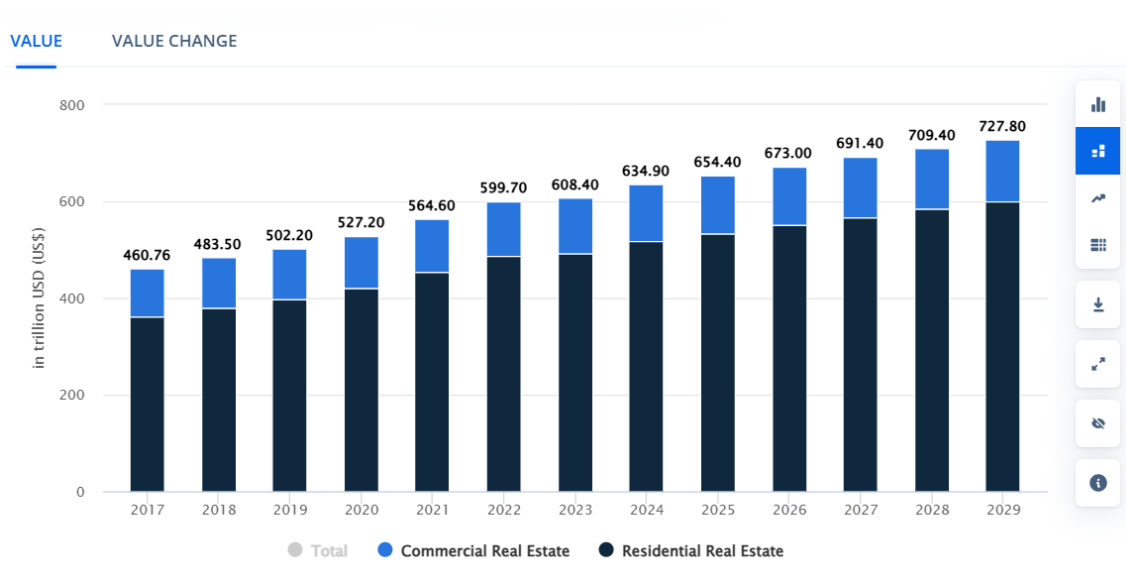


Figure 1 – Real Estate Market Value (July 2024, Source: Statista Market Insights)

3. RESEARCH OF REAL ESTATE MARKET IN SERBIA FOR THE LAST 5 YEARS

Throughout history, crises have tested the resilience of various investment options, and time and time again, real estate has shown its strength. Last few years, globally, the real estate market has faced a number of challenges, but also opportunities. The most significant features are:

- Rising real estate prices: In most countries, real estate prices have increased significantly in the last five years, partly due to the COVID-19 pandemic (Figure 3.1), which has boosted demand for residential and holiday homes.
- Increasing investment in real estate as a safe haven: Investors are seeking real estate as a safe haven in times of economic instability.
- Digitalization and smart technologies: The development of smart buildings and the digitalization of the real estate trading process have further accelerated changes in the market [6].



Figure 2 – Southern Europe Real Estate Market Value (July 2024, Source: Statista Market Insights)

University of Cambridge Emeritus Professor Colin Lizieri eloquently summarized the connection between financial institutions and real estate: “Firms that occupy space are the same firms that acquire office spaces as an investment asset (directly and indirectly) and who provide finance and funding for the creation of new office space. This interlocking creates greater potential volatility in office markets, increasing the amplitude of upswings and downswings.” It is obviously that here exists a tight interdependence between the two industries because financial services sector is strong involved in both the supply and demand sides of real estate markets [7].

The consequences of the war in Ukraine have also led to migration, with many Russians moving to Serbia and buying real estate, further increasing demand for real estate, especially in large cities [6].

The real estate market research in Serbia aims to analyze the main trends over the past five years. The goal is to identify changes in the structure of demand and supply, as well as analyze the factors that influenced changes in real estate prices and transaction volume.

The three sources of data, that enable high-quality and reliable research into prices, transaction volumes, and market structure in Serbia are:

- The Republic Serbia Statistical Office - this source provides access to additional data on demographics and economic indicators that may affect the real estate market in Serbia.
- The Real Estate Price Register,
- The Republic Geodetic Authority - the Real Estate Price Register (RCN) contains official data on real estate prices recorded in transactions, which allows for more precise analysis and validation of information from other sources.

The research process consisted of several key phases:

1. Data collection - data are downloaded from the above platforms in digital format. The property price website and the Property Price Register provided an overview of prices by property type and region, which is crucial for the analysis.
2. Data entry and processing in Excel spreadsheet - data was entered into an Excel spreadsheet for easier processing.
3. Data cleaning - after downloading, the data was cleaned to ensure the accuracy of the analysis. The cleaning process includes removing incomplete or inconsistent data, as well as checking the validity of the data to eliminate any duplicates or incorrect values.
4. Data sorting - in Excel, the data was sorted by year and dominant cities (Belgrade, Niš, Novi Sad and Kragujevac) for easier analysis.
5. Data organization and aggregation - the data was organized by year, location and number of contracts at a given time, which allows for easy analysis and comparison by different parameters.
6. Data analysis and visualization - after preparation, the data was analyzed using Power BI software, which allows for the creation of graphs and visualizations to display long-term trends, price movements, number of transactions and comparisons between different dominant cities in Serbia.

For visualization of analysis results, Power Bi was used. Power BI is a tool that enables advanced data analysis and visualization, so data can be displayed in the form of graphs and tables, which allows easy tracking of trends and simple interpretation of results. Power BI supports connecting to various data sources such as Excel, SQL Server, Azure, and many others and provides the ability to filter and compare by various parameters, such as time periods, property types, and locations [8].

Power BI is particularly suitable for analyzing market trends because it provides the following functionalities: Data visualization, Data integration, Interactivity and Easy sharing

Power BI enabled structuring and analyzing data through the following steps:

1. Import data - data collected from the CeneNekretnina.rs platform and the Real Estate Price Register was imported into Power BI. It is possible to import data in CSV, Excel format or directly from a database [7].
2. Data preparation - before analysis, the data is cleaned and transformed. This includes removing incomplete records, converting data to an appropriate format (e.g. dates, currencies) and creating new columns for analysis (e.g. average price per square meter).
3. Create data models - data was connected and organized to enable analysis by different criteria, such as property type, region and period.
4. Data visualization - creating charts, such as:
 - o Line chart: To show price trends over the years.
 - o Bar chart: To compare the number of transactions by region.
 - o Maps: Visualize the geographic distribution of prices and transactions.
5. Generate reports - Based on visualizations, Power BI had allowed creating interactive reports that make data interpretation easier.

3.1. Description of Methodology used in the research

In the first phase, data was entered into Power BI using the "Get Data" option. Data sources (Excel spreadsheet, official data from websites) are loaded into the Power BI model (Figure 3). After data entry, the next step was data cleaning. This process included removing missing values, correcting data errors, and formatting the data for further analysis. Using Power Query Editor, data transformations were performed to ensure data accuracy and quality. Power BI was used to create various types of visualizations, such as "Clustered Column Chart", "Line Chart" and "Pie Chart" to display key market trends, price movements and real estate turnover numbers.

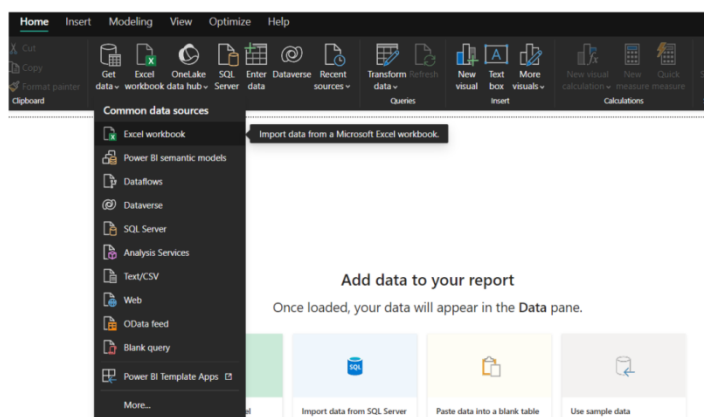


Figure 3 – Import of data in Power Bi

Based on the data from the pie chart (Figure 4), it can be seen that more than half of the population of Serbia lives in the three largest cities: Belgrade, Novi Sad and Niš. The percentages of the population by city are: Belgrade 37.99%, Novi Sad 8.34%, Niš 5.64%, Kragujevac 3.87%, the rest: 44.17% [9], [3]

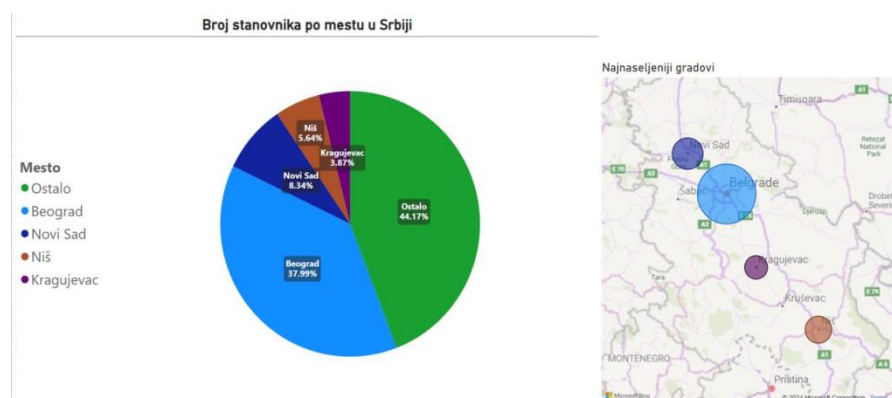


Figure 4 – Number of inhabitants in cities

Figure 5 shows the number of real estate transactions by quarter and year in the main cities of Serbia (Belgrade, Novi Sad, Niš and Kragujevac) in the period from 2019 to 2024. This gives insight into seasonal changes and the general trend in the number of transactions. [11], [12]. This data is presented using a Clustered Column Stack diagram.



Figure 5 – Trends in main cities of Serbia

4. CONCLUSION

In this paper, the real estate market in Serbia over the past five years was analysed, using data analysis tools. Due that demographic analysis showed that more than half of the population lives in four cities (Belgrade, Novi Sad, and Niš), their importance for the real estate market is emphasized.

The real estate market in Serbia is expected to continue to grow in the coming period. It is predicted that there will be an increase in the number of real estate sales, especially in large urban centers such as Belgrade, Novi Sad and Niš. Real estate prices will likely continue to grow due to stable demand and limited supply of new construction. Belgrade shows a stable number of real estate transactions throughout the period, with a slight increase in the first and second quarters of 2024. However, there is a significant drop in the number of transactions in the third quarter of 2020, which may be a consequence of the global COVID-19 pandemic. Novi Sad sees an increase in the number of real estate transactions from 2019 to 2021, followed by stagnation and a slight decline in the following years. This trend may indicate market saturation or economic factors affecting the demand for real estate in this city. Niš shows a constant increase in the number of real estate transactions, with the highest number recorded in the third quarter of 2021. This city is recording a steady increase in interest in real estate, which may be related to a growing economy and improved infrastructure. The number of real estate transactions in Kragujevac shows a stable trend with slight oscillations over the years. Although the number of transactions is lower compared to other cities, there is a stable interest in real estate in this city, especially in the first quarter of 2024.

Belgrade and Niš show the greatest stability and growth in the number of real estate transactions, which indicates high demand and continued economic growth in these cities. Novi Sad shows stagnation and a slight decline, which may indicate market saturation or a change in economic conditions. Kragujevac has a stable but lower number of real estate transactions compared to other cities, which indicates moderate demand in this region.

The highest number of real estate purchases is in the first quarter, while the lowest activity is in the third quarter, which is a common trend for all cities.

Positive economic indicators and growing investment activity will further support this trend, contributing to a stable and growing real estate market in Serbia.

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